

## CLAIMS

- 5 1. A needle (1) for penetrating a membrane (2), having a pointed end (3) provided with a penetrating tip (4) and with an opening (6) for letting a liquid in and/or out in a main direction (7) which is substantially parallel to the longitudinal extension of the needle, **characterized in that** the penetrating tip (4) is designed with a substantially point-shaped edge (8) to initially prick a membrane (2) when the  
10 membrane is penetrated and that the outer edges (19) present on the pointed end (3) in the area between the point-shaped edge (8) and a position (25) beyond the opening (6) are rounded so that after the initial penetration the pointed end (3) will push the membrane material away rather than cutting the membrane material.
- 15 2. A needle according to claim 1, **characterized in that** the inner edge (21) of the opening (6) is rounded.
- 20 3. A needle according to claim 1 or 2, **characterized in that** the penetrating tip (4) is designed with a cross section (26) having a symmetry causing at least three substantially equally sized forces (F) in different directions which are radial to the longitudinal centre line (5) of the needle and which forces counteract each other so that the needle (1) will tend not to deviate from the initial penetration direction when the needle (1) penetrates a membrane (2).
- 25 4. A needle according to claim 3, **characterized in that** the cross section is substantially triangular with rounded edges.
- 30 5. A needle according to claim 3, **characterized in that** the cross section is substantially circular.
- 35 6. A needle according to any of claims 1-5, **characterized in that** the point-shaped edge (8) of the penetrating tip (4) is arranged to lie substantially on the longitudinal centre line (5) of the needle (1).
7. A needle according to any of claims 1-6, **characterized in that** the pointed end

(3) has a shape substantially corresponding to a part of an imaginary cone, the tip (9) of which coincides with the substantially point-shaped edge (8).

5 8. A needle according to any of claims 1-7, **characterized in that** at least a major part of the opening (6) is arranged on one and the same half of the cross section of the needle (1).

10 9. A needle according any of claims 1-8, **characterized in that** the pointed end (3) is provided with a basic shape in accordance with a lancet bevel cut.

10 10. A needle according any of claims 1-9, **characterized in that** the pointed end (3) is provided with a basic shape in accordance with a back bevel cut.

15 11. A needle according to claim 10, **characterized in that** the back bevel cut has a tip angle ( $\alpha$ ) in the interval 20° to 50°.

12. A needle according to claim 10, **characterized in that** the back bevel cut has a tip angle ( $\alpha$ ) in the interval 50° to 100°.

20 13. A needle according to claim 10, **characterized in that** the back bevel cut has a tip angle ( $\alpha$ ) in the interval 30° to 80°.

25 14. A needle according to claim 12 or 13, **characterized in that** the tip angle ( $\alpha$ ) is approximately 75°.

15. A needle according any of claims 10-14, **characterized in that** the back bevel cut has a second grind angle ( $\beta$ ) in the interval 50° to 140°.

30 16. A needle according to claim 15, **characterized in that** the second grind angle ( $\beta$ ) is approximately 100°.

17. A needle according to any of claims 1-10, **characterized in that** the needle is provided with a tip angle ( $\alpha$ ) in the interval 20° to 100°.

35 18. A needle according to claim 17, **characterized in that** the tip angle ( $\alpha$ ) is in the

interval 30° to 80°.

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19. A needle according any of claims 1-10, **characterized in that** the needle is provided with a rear angle ( $\beta$ ) in the interval 50° to 140°.
20. A needle according to claim 19, **characterized in that** the rear angle ( $\beta$ ) is approximately 100°.
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21. An arrangement for transferring a liquid, comprising a membrane (2) and a needle (1) for penetrating the membrane (2), said needle (1) having a pointed end (3) provided with a penetrating tip (4) and with an opening (6) for letting a liquid in and/or out in a main direction (7) which is substantially parallel to the longitudinal extension of the needle (1), **characterized in that** the penetrating tip (4) is designed with a substantially point-shaped edge (8) to initially prick a
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- membrane (2) when the membrane is penetrated and that the outer edges (19) present on the pointed end (3) in the area between the point-shaped edge (8) and a position (25) beyond the opening (6) are rounded so that after the initial penetration the pointed end (3) will push the membrane material away rather than cutting the membrane material.
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22. An arrangement according to claim 21, **characterized in that** the inner edge (21) of the opening (6) is rounded.
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23. An arrangement according to claim 21 or 22, **characterized in that** the penetrating tip (4) is designed with a cross section (26) having a symmetry causing at least three substantially equally sized forces (F) in different directions which are radial to the longitudinal centre line (5) of the needle and which forces counteract each other so that the needle (1) will tend to not deviate from the initial penetration direction when the needle (1) penetrates a membrane (2).
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24. An arrangement according to claim 23, **characterized in that** the cross section is substantially triangular with rounded corners.
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25. An arrangement according to claim 23, **characterized in that** the cross section is substantially circular.

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26. An arrangement according to any of claims 21-25, **characterized in that** the point-shaped edge (8) of the penetrating tip (4) is arranged to lie substantially on the longitudinal centre line (5) of the needle (1).
27. An arrangement according to any of claims 21-26, **characterized in that** the pointed end (3) has a shape substantially corresponding to a part of an imaginary cone, the tip (9) of which coincides with the substantially point-shaped edge (8).
- 10 28. An arrangement according to any of claims 21-27, **characterized in that** at least a major part of the opening (6) is arranged on one and the same half of the cross section of the needle (1).
- 15 29. An arrangement according any of claims 21-28, **characterized in that** the pointed end (3) is provided with a basic shape in accordance with a lancet bevel cut.
- 20 30. An arrangement according any of claims 21-29, **characterized in that** the pointed end (3) is provided with a basic shape in accordance with a back bevel cut.
31. An arrangement according to claim 30, **characterized in that** the back bevel cut has a tip angle ( $\alpha$ ) in the interval 20° to 50°.
- 25 32. An arrangement according to claim 30, **characterized in that** the back bevel cut has a tip angle ( $\alpha$ ) in the interval 50° to 100°.
- 30 33. An arrangement according to claim 30, **characterized in that** the back bevel cut has a tip angle ( $\alpha$ ) in the interval 30° to 80°.
34. An arrangement according to claim 32 or 33, **characterized in that** the tip angle ( $\alpha$ ) is approximately 75°.
- 35 35. An arrangement according any of claims 30-34, **characterized in that** the back bevel cut has a second grind angle ( $\beta$ ) in the interval 50° to 140°.

36. An arrangement according to claim 35, **characterized in that** the second grind angle ( $\beta$ ) is approximately 100°.

5 37. An arrangement according to any of claims 21-30, **characterized in that** the needle is provided with a tip angle ( $\alpha$ ) in the interval 20° to 100°.

38. An arrangement according to claim 37, **characterized in that** the tip angle ( $\alpha$ ) is in the interval 30° to 80°.

10 39. An arrangement according any of claims 21-30, **characterized in that** the needle is provided with a rear angle ( $\beta$ ) in the interval 50° to 140°.

15 40. An arrangement according to claim 39, **characterized in that** the rear angle ( $\beta$ ) is approximately 100°.

20 41. A needle for penetrating a membrane (2), said needle (1) having a pointed end (3) provided with a penetrating tip (4) and with an opening (6) for letting a liquid in and/or out in a main direction (7) which is substantially parallel to the longitudinal extension of the needle (1), **characterized in that** the penetrating tip (4) is designed with a cross section (26) having a symmetry causing at least three substantially equally sized forces (F) in different directions which are radial to the longitudinal centre line (5) of the needle and which forces counteract each other so that the needle (1) will tend not to deviate from the initial penetration direction when the needle (1) penetrates a membrane (2).

25 42. A needle according to claim 41, **characterized in that** the cross section is substantially triangular with rounded corners.

30 43. A needle according to claim 29, **characterized in that** the cross section is substantially circular.

35 44. A needle according to any of claims 41-43, **characterized in that** the point-shaped edge (8) of the penetrating tip (4) is arranged to lie substantially on the longitudinal centre line (5) of the needle (1).

45. A method for manufacturing a needle (1) for penetrating a membrane (2), comprising:

5 cutting a tubular blank (15) obliquely for obtaining a pointed end (3) provided with a penetrating tip (4) and with an opening (6) for letting a liquid in and/or out in a main direction (7) which is substantially parallel to the longitudinal extension of the needle (1),

10 **characterized by** providing the penetrating tip (4) with a substantially point-shaped edge (8), and

rounding all outer edges (19) present on the pointed end (3) in the area between the point-shaped edge (8) and a position (25) beyond the opening (6).

- 15 46. A method according to claim 45, **characterized by** rounding the inner edge (21) of the opening (6).

- 20 47. A method according to claim 45 or 46, **characterized by** shaping the penetrating tip (4) with a cross section (26) having a symmetry causing at least three substantially equally sized forces (F) in different directions which are radial to the longitudinal centre line (5) of the needle (1) and which forces counteract each other so that the needle (1) will tend not to deviate from the initial penetration direction when the needle (1) penetrates a membrane (2).

- 25 48. A method according to any of claims 45-47, **characterized by** arranging the point-shaped edge (8) of the penetrating tip (4) to lie substantially on the longitudinal centre line (5) of the needle (1).

- 30 49. A method according to any of claims 45-48, **characterized by** shaping the pointed end (3) as a part of an imaginary cone, the tip (9) of which coincides with the substantially point-shaped edge (8).

- 35 50. A method according to any of claims 45-49, **characterized by** shaping the pointed end (3) so that at least a major part of the opening (6) will be located on

one and the same half of the cross section of the needle (1).

51. A method according to any of claims 45-50, **characterized by** grinding the penetrating tip (4) in accordance with a lancet bevel cut before rounding the outer edges of the pointed end (3).
52. A method according to any of claims 45-51, **characterized by** grinding the penetrating tip (4) in accordance with a back bevel cut before rounding the outer edges of the pointed end (3).
53. A method according to any of claims 45-52, **characterized by** shaping the penetrating tip (4) by a non-cutting process, such as forging, hammering or similar.
54. A method according to any of claims 45-53, **characterized by** rounding the outer edges (19) by blasting and/or electrochemical polishing.
55. A method according to claim 46, **characterized by** rounding the inner edge (21) of the opening (6) by blasting and/or electrochemical polishing.